

Neutrino Scattering Theory Experiment Collaboration (NuSTEC) Statement on the relevance of neutrino interactions for the future of Neutrino Physics Research.

To reach the full potential of the neutrino-physics program, in which the US plays a vital role, a better understanding of neutrino interactions with matter is crucial. The precision goals of the oscillation program can only be achieved with a realistic modeling of neutrino-nucleus scattering dynamics, based on solid theory and comprehensive measurements.

NuSTEC is a collaboration of theorists and experimentalists focused on the circular dependency of the collection and analysis of data, model development and tuning, and incorporation of these models in neutrino event generators. NuSTEC fosters communication and collaboration between experiments and theory groups through working groups, workshops, schools and white papers (eg, see <http://www.sciencedirect.com/science/article/pii/S0146641018300061>.)

Progress in this field cannot wait until the next generation of neutrino measurements becomes limited by systematic uncertainties. The process of collecting and analyzing new measurements, developing and tuning models based on those data, and incorporating these models in generators can take many years. In addition, neutrino-nucleus scattering measurements expected in coming years will cover only a fraction of the phase space and nuclear targets needed to make real progress. Therefore NuSTEC will continue to pursue and advocate for increased support for neutrino-related HEP, nuclear theory and lattice QCD efforts, neutrino event generator development, new precision neutrino-H/D2/He4 scattering measurements, complementary electron scattering experiments and other topics that can lead to improvement in neutrino- nucleus scattering physics. Considerable impact is expected for the precise determination of neutrino properties but also in supernova, beyond the Standard Model, hadronic and nuclear physics.

NuSTEC collaborators are already involved in several Snowmass-related projects, each with the goal of producing Lols and eventual white papers. These include topics and proposals related to Shallow Inelastic and Deep Inelastic Scattering (SIS/DIS), “elementary” neutrino scattering (eg, off of hydrogen), and hadron production measurements for improved neutrino flux predictions. We welcome any member of the neutrino community to join our efforts, please let me or any other NuSTEC collaborator you know if you are interested.

I now remove my “NuSTEC representative” hat with the following personal opinion and suggestion: the HEP community has long struggled with the artificial “stove-piping” between the different Programs of the DOE Office of Science. In Neutrino Physics, progress in critical cross-cutting

research between Nuclear and Particle Physics has been stymied in the US because of these stove pipes. Multi-disciplinary national laboratories and universities are able to find work-arounds at some level, but there are always hoops to jump through. Both DOE Nuclear Physics and the NSF both have successful bridge programs that are examples we could follow. I propose that we, the Neutrino and HEP community, push for the creation of formal interdisciplinary funding opportunities in the DOE Office of Science to bridge the major DOE Program Offices. This includes formal bridges between the Offices of High Energy Physics, Nuclear Physics, ASCR, BES, BER and Fusion Energy Sciences. The details of how these bridge funding opportunities will have to be worked out of course, but I believe they will increase communication and collaboration across these scientific fields and result in large gains in scientific progress.